

Reclaiming Garbage: Interaction Design for Participation

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Abstract: Since the introduction of organized sanitation practices in the West, local governments and waste management business in the private sector have essentially adhered to an out-of-sight, out-of-mind approach to residential garbage, by which, for a modest fee, individuals are relieved from responsibility for their own waste and from awareness of its impact on the planet. Together with the systematic deferral of the environmental costs of current activities, this out-of-sight, out-of-mind approach has fostered individual behaviors that exert a great deal of pressure on the environment. Current environmental challenges and rising environmental concern now dictate a greater awareness of the impacts of individual choices. This paper proposes that interaction design can play a significant role in breaking through the garbage “taboo,” helping to open up existing sources of data about waste in such a way as to stimulate individual participation in sustainable practices, such as waste diversion and source reduction programs. To demonstrate the relevance of interaction design to the challenge I use the example of the California Waste Stream Profiles, a database of information about municipal solid waste in California. The exercise delivers a basic set of interaction design principles to support individual sustainability that can be applied more broadly to sustainability at an individual level.

Keywords: Waste; sustainability; participation; motivation; interaction design.

1. INTRODUCTION: DEFINING THE PROBLEM

Modern sanitation practices in the US were born in the waning years of the 19th century. Driven by a public health and nuisance abatement agenda and propelled by indescribably filth in the larger cities across the continent, these practices focused primarily on shielding individuals from their own garbage. Trash lay so thickly in the streets of cities like New York that it formed an impediment to effective transportation.¹ The mandate of the municipal collection services and private haulers of the time was primarily to make the garbage go away and secondarily to produce some income with which to defray expenses for such services as street-sweeping. Initially, almost all the garbage was reused—sorted and recycled, fed to pigs, boiled and rendered for fertilizer, burned to generate steam, and even used for fill to “improve” real estate values.

But this general approach of simply making away with residential garbage and not burdening the producers with the details is not relevant to the challenges of our time. We’ve come to think that real estate values are not improved by the addition of trash, in part because our garbage has become highly toxic with the addition of metals, plastics, and chemicals. Now garbage is simply buried and preserved in highly engineered environments that try to reduce the production of methane and leachate attendant upon biodegradation. In addition, the volume has swelled precipitously since World War II, while landfill space is becoming a scarce commodity.² Older landfills have been determined almost without exception unsafe in the last 20 or 30 years and have been closed at a much faster rate than

¹ Miller (2000) contains the most fulsome descriptions of waste in New York City, including one startling photograph taken late in the 19th century of a street where garbage lay knee-deep over the entire length and width of the street and sidewalks.

² Melosi (2004) refers to an estimate of remaining space of approximately 18 years, which means current landfill would fill up by 2022. More aggressive diversion goals in the past few years may have pushed that horizon a little further out.

new landfill is being created. Siting new landfill is extremely difficult, being fraught with environmental regulation and further hampered by popular aversion and NIMBY-ism.³ In consequence, state governments are hard at work to reduce the amount of waste that ends up in landfill within their own state. Some of this political activity merely attempts to shift burdens, as certain states look to export as much of their garbage as possible, while states that still have sufficient landfill space are beginning to ban imports.⁴ More permanent solutions are also pursued, mostly by setting significant waste reduction goals. One example is California's goal of 75% diversion from landfill by 2010. Local governments sometimes add aspirational goals of their own, such as San Francisco's zero waste goal by the year 2020. Meanwhile, it is worth noting that, despite increasing diversion rates, the average volume of garbage buried in landfill is still increasing year by year as the US population grows, while per capita the numbers have held more or less steady since 1992, as packaging material becomes ever more voluminous.⁵

Responsibility for achieving diversion goals is mostly in the hands of local governments, which look primarily to recycling to relieve pressure on dwindling landfill space. There are plenty of reasons to quarrel with the emphasis on recycling, as opposed to source reduction, but I will set aside such objections for the moment, to focus on the challenge of individual participation in existing programs. When it comes to recycling, limitations on waste diversion are not only posed by fluctuating markets for recovered materials, but also by residential and commercial participation in source separation. In many cases participation stays well below the ceiling imposed by markets, even under current conditions favoring the use of virgin materials.⁶

San Francisco's effort to collect compostibles separately from garbage that goes to landfill offers an instructive example of recycling limited by participation rather than market conditions. The program is voluntary and currently garners a 40% participation rate.⁷ Not all residents who participate do so full-time.⁸ NorCal, the waste management company that implements the San Francisco program, has no difficulty bringing the resulting compost to market at current participation rates. Without increases in participation, San Francisco is unlikely to reach the state-mandated diversion goal of 75% by 2010.⁹ NorCal employs a team of people who go door to door attaching information to residents' garbage cans to alert them to the possibility of reducing their landfilled waste by separating out food waste. A modest financial incentive is offered, in the form of lower monthly rates for households that manage to drop a size in waste bins. NorCal does not believe it is possible to increase participation further without making it mandatory, as Seattle has opted to do. San Francisco recently announced an intention to make source separation mandatory and to impose fines for failures to comply.¹⁰

However, whether large-scale composting and other recycling programs are mandatory or not, the success of such programs largely depends on the willingness of the public to accept and pursue changes in behavior. For that reason, it is important to look beyond the

³ Pellow (2002) traces the phenomenon to the 1980s, when "the environmental movement's mass mobilization precipitated a 'landfill crisis' by rendering the siting waste of facilities [sic] nearly impossible" (p. 54).

⁴ Some of these efforts are clearly for present political gain and take little account of environmental imperatives or even common sense. For instance, North Carolina last year declared a moratorium on garbage imports even though exports have exceeded imports in that state for several years running.

⁵ See Zero Waste America, Statistics, <http://www.zerowasteamerica.org/Statistics.htm>.

⁶ Glass cannot always be profitably recycled, while the recycled paper markets swing significantly, so that increasing participation in source separation may not invariably result in increased diversion rates for these materials. However the recycle rate for aluminum, the most profitable recyclable material, lies near 50% nationally, while the market would easily absorb a 100% rate.

⁷ Based on an interview with Bob Besso, Waste Diversion Program Director for NorCal, on January 31, 2008.

⁸ In a recent qualitative study, several participants noted that they separate food scraps only about half the time, mostly for practical reasons (Rijsberman, 2008).

⁹ Bob Besso, interview with the author, January 31, 2008.

¹⁰ Decision of April 22, 2008.

motivational repertoire of (sometimes very modest) financial incentives and behavioral rules imposed from above. Proper alignment of financial incentives and convenient separation and collection systems is undoubtedly important in pushing participation rates, but neither are likely to drive the desired behavior by themselves.¹¹

It follows, then, that the very success of the revolution in sanitation, by which residential and commercial waste essentially became invisible to those who produced it, now threatens the viability of waste reduction goals. It shields individuals from the knowledge of why their own efforts matter, knowledge that might help motivate their participation in environmental programs. Garbage is our most concrete—and, given current waste management practices, permanent—contribution to the environment. The question of what happens to it is not idle and can reasonably be expected to have an impact on individual behavior. Interestingly enough, individuals are asking this question online, submitting queries such as “what happens to our garbage” to the major search engines (Rijsberman, 2008).

2. EXISTING ONLINE TOOLS

How might interaction design be applied to this complex challenge of disclosing information about household waste in order to increase individual participation rates in environmental sustainability, such as San Francisco’s food waste recycling program? The general goal would be to make available environmental information in such a way as to increase the (perceived) benefits and lower the (perceived) obstacles to the desired behavior. I propose that better disclosure of the fate of landfilled garbage, couched in highly concrete and individual terms—what happens to **your** garbage after you set it by the curb?—may contribute to increasing the perceived benefits of participation. That is, interaction design can help break through the garbage taboo by presenting information in a highly engaging fashion. At the same time, bringing to bear local communities through the use of social software applications offers a possibility of lowering the barriers to participation.

To demonstrate the possible deployment of such a two-pronged approach, I turn to an especially rich and public source of information about waste in California, the California Waste Stream Profiles maintained by the California Integrated Waste Management Board (CIWMB), the regulatory agency that oversees solid waste management in the state and holds first-line responsibility for implementing the state’s waste reduction mandate. The California Waste Stream Profiles data is publicly accessible on the CIWMB website (www.ciwmb.ca.gov).¹² It contains a wealth of information about the volume, movement, and diversion of municipal solid waste at the town, county, and state level, as well as an exhaustive inventory of active and closed, legal and illegal landfills and other waste handlers. I chose this dataset for demonstration purposes because I have used it for years for my own research related to garbage and have found it invaluable (though often frustrating) for the information it contains—data about the fate of garbage in California that is directly relevant to individual consumers. However, the CIWMB does not appear to have realized that this is the case and makes the information available in a manner highly unlikely to encourage behavior change or even discovery.

The CIWMB does in fact address individuals on its website, because it clearly has an interest in their behavior. For example, some of the materials contained in a section called “Reduce Waste” are relevant to individual householders. Waste Prevention World (<http://www.ciwmb.ca.gov/WPW/>) is described as a “site about doing more with less, with information for individuals, businesses, and governments on a wide range of waste reduction topics.” “Waste Reduction at Home” (<http://www.ciwmb.ca.gov/WPW/Home/>) offers

¹¹ Participants in the qualitative study referenced above cited a lack of convenience as a barrier (Rijsberman, 2008). Since no waste separation system can be as convenient as a pitching all trash into a single barrel, it follows that individuals require some motivation outside of convenience to adopt the desired behavior.

¹² The CIWMB is not involved with the work described in this paper. Attempt to speak to staff and management at CIWMB about the possibility of offering a consumer-friendly interface for the waste data have failed to elicit a response.

advice: buy in bulk, bring unwanted articles to re-sellers, avoid disposables, and so on. In principle, consumers can contribute to the Waste Prevention Information Exchange (<http://www.ciwmb.ca.gov/WPIE/>), although Web2.0 has not yet penetrated to the CIWMB and the contributor has to email information to a site manager for inclusion in the exchange.

The consumer-oriented resources have significant drawbacks. The information architecture is confusing to say the least, and all the information is extremely text-heavy. None of the standards of social marketing or instructional design seem to have been applied in the design. However, the most significant problem with the pages is that all the information focuses on what you can do to reduce waste, completely bypassing the issue of why you should bother in the first place. Although the CIWMB is sitting on a treasure trove of information about garbage and how it impacts the local environment, the materials that specifically address household waste don't offer the consumer any way in to that data. There is nothing about the numbers, the consequences to the California landscape, or the environmental challenges posed by landfills, in all their precariousness. The landfill and waste stream information is so separate from the advice and so hard to find, that no consumer without a special wish and a dogged determination to find it would ever run the waste data to ground. In other words, the CIWMB website carefully preserves the taboo on trash that's now been with us for more than 100 years. Luckily, the information to help us break through that taboo is on hand within the CIWMB California Waste Stream Profiles, even if it takes a great deal of perseverance to get to it.

Table 1: Source CIWMB's California Waste Stream Profiles.

Location (County)	Steps	Landfill (Town,County)
San Francisco	65	Altamont Landfill (Livermore, Alameda)
Antioch (Contra Costa)	47	Keller Canyon (Pittsburg, Contra Costa)
Bakersfield (Kern)	38	Bakersfield Sanitary Landfill (Bakersfield, Kern)
Red Bluff (Tehama)	14	Red Bluff Sanitary Lanfill (Red Bluff, Tehama)

I checked the clickpath for the city of San Francisco and several other communities, including a smaller town in the Bay Area, a large urban conglomeration in the Central Valley and a small agricultural town in Northern California. In rural areas, the garbage situation is relatively straightforward and the clickpath to the data is shortest (see Table 1). But it takes 38 steps to determine that the lion's share of Bakersfield garbage stays in Bakersfield, and the number rises further for communities in urban conglomerations.

Many of these steps require informed choices. If you don't know that Antioch is considered a jurisdiction, add a few steps. If you don't know that the destination of Antioch's garbage is hidden inside a Waste Flows tab which points to a different set of pages which provide a roundabout answer, add many more steps. And of course this only takes the consumer to a knowledge of where the garbage goes, which is not quite the same as knowing what happens to it.

3. GENERAL DESIGN PRINCIPLES

Of course, it makes little sense to lambaste the California Waste Stream Profiles for doing a poor job of something it didn't set out to do and has yet to discover the usefulness of. It will be more profitable to consider the basic design principles that could inform a consumer-oriented interface for the data contained in the Waste Stream Profiles. The first concern is to apply general best practices from interaction design, including a need to shorten the clickpath and to use terminology that aligns with lay usage. But if the objective is to motivate people to participate in waste reduction, then a variety of other design criteria will need to come into play that are fundamentally different from the challenges posed by an ecommerce application, a productivity tool, or a collaboration environment, to mention just a few standard examples. The existing literature on the relevance of interaction design to sustainability, insofar as I am familiar with it, approaches sustainability from the opposite direction, working towards sustainable products rather than towards sustainable individuals

making informed lifestyle choices.¹³ As a starting point, I propose that, to motivate behavior changes based on environmental concerns, an individual needs

1. Knowledge about the problem at hand as well as the potential solutions
2. Engagement with that challenge through an emotional connection with the information
3. A viable sense of identity as part of the solution, primarily to be conveyed through a connection to the local community

3.1 Knowledge

In *Fostering Sustainable Behavior*, Dough McKenzie-Mohr points out that the most effective way to convey environmental information to motivate behavioral changes towards greater sustainability is a two-step process. The first step is revelation. This involves bringing home the impact of the problem, without pulling punches or mincing words. The second step is reassurance that concrete steps can be undertaken to solve the problem (McKenzie-Mohr, 1999, pp. 90-91).

In terms of this paper's chosen issue of household waste, the revelation is a challenge in framing the problem appropriately, and this means learning from things that have not worked in the past. The alarm about garbage was first raised by journalists in the 1980s, when the dearth of landfill in the Northeast precipitated a gradual transition to the exportation of garbage to other states west and south. The alarm died down again when the new patterns involving long-distance transportation were established. The eventual "solution" is in fact an environmental setback on three counts. Transportation of garbage across huge distances is associated with a significant increase in the use of fossil fuels and output of emissions for every ton of garbage landfilled.¹⁴ Moreover, exports of garbage to poor and remote areas negatively affect the balance both of environmental justice and also of unspoiled natural assets. While recycling was introduced in many places following the so-called "garbage crisis," the total per capita production of garbage has nevertheless risen significantly. In other words, it is apparent that framing the problem as an issue of landfill *space* does not lead to behavioral changes that make a positive difference.

It is more appropriate to frame the problem in terms of individual responsibility for the production of astonishing amounts of garbage, which is toxic and permanent, and which under current conditions ends up in a real place, as a persistent embarrassment in the landscape. In the case of California, most municipal solid waste in fact ends up within state boundaries and often in the same county or a neighboring one, in places that are immediately recognizable and meaningful to individuals. The Waste Stream Profiles can make the difference here. Following the admonitions of McKenzie-Mohr, it is also important to add specific suggestions for making a difference—such as participation in food waste separation and becoming a more discriminating consumer with respect to such things as product packaging and durability.

3.2 Engagement

I use engagement here in a double-edged way, as a sense that certain problems have direct relevance to oneself, as well as "a feeling of belonging, an experience of investment and ownership in the local, regional, national, and/or international political communities to which citizens belong," as Wikipedia defines civic engagement.¹⁵ What matters in terms of engagement is the concrete and specific in a local context that manifests itself as a community. This makes it important not to talk about a national or global challenge that is easily overwhelmingly difficult to comprehend and solve. While the larger environmental challenges are not irrelevant, the focus is appropriately on the local community and the individual's personal impact.

¹³ See for example Fogg (2002) or the literature review on Debra Lilley's Design Behavior website http://www.lboro.ac.uk/research/susdesign/design-behaviour/what_is_it.htm.

¹⁴ Benjamin Miller, currently at work on a study of transportation, shows that solid waste is trucked extremely long distances, often passing many active landfills along the way. Email communication with the author, October 24, 2007.

¹⁵ http://en.wikipedia.org/wiki/Civic_engagement

The local community is also important in the sense that individuals don't usually make changes in patterns of consumption and handling of their own waste products in isolation. People often learn in community, as became clear in my qualitative study of participation patterns in San Francisco (Rijsberman, 2008). One participant explained that she separates food waste because "it is the right thing to do for the environment. Our preschool (a progressive co-op) started composting 4 years ago and so I was able to learn through that the vast amount of things that can be composted, and it has made a big difference in the amount of our trash." McKenzie-Mohr points out that social marketing has been shown to be more effective when mediated through direct contact: "Community-based social marketing draws heavily on research in social psychology which indicates that initiatives to promote behavior change are often most effective when they are carried out at the community level and involve direct contact with people" (McKenzie Mohr, 1999, pp. x-xi).

The principle of engagement, then, suggests that personal responsibility and local community both need to be addressed in the challenge of designing for environmental change. Space for collaborative problem-solving and community building will both help support the ultimate goal of designing for individual behavior change.

3.1 Identity

People who do participate in source separation programs invariably say they do it for environmental, not financial reasons, even if they sometimes mention the cost savings as a nice perk (Rijsberman, 2008). A significant sub-theme is formed by a reflection on identity, a thought about who the participant is and who he or she would wish to be. One man explained that "I don't want to have to think of myself as the kind of person who just leaves my trash to future generations." The perspective of future generations, as a lens on current behavior patterns that brings identity issues into focus, is mentioned with some frequency. "My kids are going to look back at us and wonder how we could do it," noted one participant, "just like we look back to our parents' generation and think, how could they just throw their trash in the water?" (Rijsberman, 2008).

Advertising of consumer products has been very successful driving consumers in the opposite direction, creating desirable identities based on ownership of those products. But keeping up with the Joneses is not just a mechanism that drives to ever-increasing consumption. It can also work in the opposite direction. In a different field, the obesity study that came out in the *New England Journal of Medicine* in 2007 also underscores the conclusion that individual behaviors develop in a social context (Christakis, 2007). Possibly there is something to learn from the techniques that have been employed, as the field of social marketing attempts to do. Perhaps demystification of these manufactured consumerist identities will also be helpful. But first and foremost, the challenge for interaction design is to engage the community in articulating and creating an alternative identity.

While it is clear that a significant number of people, at least in the vicinity of San Francisco, do not wish to be personally implicated in an environmentally oblivious and even environmentally predatory identity, the alternatives may not be especially appealing. One participant in the study referenced above remarked that when she first awakened to the seriousness of the environmental challenges facing the planet, she didn't want to be perceived as an environmentalist. That identity had been contaminated, in a similar vein as the identity of "feminist" was contaminated in the 1970s and 1980s, by an idea of a certain strident unreasonableness, beyond the pale and outside the discourse of one's own community. This suggests that part of the interaction design challenge is stewarding a process of discovering a viable alternative. If we don't want to be the people who preserve their leftovers in gigantic, unstable piles (sometimes in or near their own communities, but preferably in someone else's), so that they can indulge in unbridled consumption, then who do we want to be and how do we get there? Since we don't yet have good answers to that question, the best option is to facilitate the process by which the answers may be articulated.

3. SKETCHING AN ALTERNATIVE DESIGN

It is possible to imagine many different designs of a consumer-oriented interface for the California Waste Stream Profiles that answers the above design parameters. Preliminary sketches for an alternative interface for the Waste Stream Profiles data (available online focus first of all on a simple two-step search that shows the user where garbage produced in a particular community ends up.¹⁶ Unlike the existing interface, the consumer-oriented interface sketch assumes that landfill is of interest to the general public, both as destination of the garbage individuals produce and as elements in the landscape they inhabit. Search result provide the same data that are available in the California Waste Stream Profiles, but it does so in a single step. The resources now offered by the CIWMB in an independent area of the CIWMB website are envisioned as displayed in the context of the search. Perhaps more importantly, the alternative interface sketch envisions the presence of video to explain to a lay audience how the principles of modern sanitary engineering are applied in landfill construction and what that means for the garbage we produce.

The alternative sketch also assumes that the information about facilities now made available by the CIWMB (information about operations, environmental studies, permits, etc.) is best provided in the form of a wiki, to invite engagement and participation in the process of producing the knowledge of what happens to garbage (see Figure 7 of the alternative interface sketch). The wiki offers users the opportunity to add a layer of oral history and visual memory, as a form of recuperation and reanimation of a near-invisible aspect of our society. Such a wiki seeks to encourage a stronger sense of place and a greater awareness of the environmental cost of individual behaviors. The intention behind the presentation of landfill-related information is primarily one of description, providing a kind of inventory of what exists and how people relate to it rather than an environmental analysis or a cautionary tale with an axe to grind.

Both the Landfill Wiki (Figure 7) and the Community Compass (Figures 8 and 9) are in service to the engagement and identity principles. The collaborative wiki approach to the landfill information makes it possible for users to take ownership of the pages and to add their own stories and photographs to the general, more impersonal information supplied by the CIWMB. The Community Compass component makes an effort to connect users to others in their own community who have an interest in environmental issues and in changing their own behaviors to reduce their environmental load. Social software is used, then, to enable people to better understand and negotiate their local geography and to connect to the local community. Figure 9 offers a general impression of how a map-based search interface might tie online interaction to a sense of community, by enabling users to find like-minded people in their own neighborhood.

A way to present oneself to the rest of the community in terms of environmental aspirations, competencies, habits, and questions, is also envisioned, to support a sense of identity as an environmental actor. One might imagine here some system by which environmentally-motivated interactions with the website (the posting of events, the participation in discussions, and so on) as well as data from the individual's shared in the individual profile could all contribute to the person's status in the community, which in turn can be visualized in the map. Discussion capabilities, meanwhile, would help support a collaborative community-based learning process.

3. SKETCHING AN ALTERNATIVE DESIGN

The design of such an alternative is crucially dependent on two other processes: on-going user research to support an iterative design cycle on the one hand and stewardship of the community aspects on the other. The proposed alternative interface sketch would need to be validated, adjusted, and further developed in an iterative design and testing cycle before being built, to determine its likely effectiveness as an illustration of the design parameters that would bridge between environmental information and the sustainability of individual

¹⁶ Available at <http://www.interfacility.com/experiencewriting/garbage.html>), Figures 5 and 6. Comments are welcomed in Rijsberman, "What Happens to Our Garbage," at <http://landfill.wordpress.com/2008/02/03/what-happens-to-our-garbage/>.

behavior. Further research would appropriately focus on the validation of the proposed design principles as well, leading in the longer term to the development of best practices for interaction design in the service of individual sustainability.

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